ULTRA HIGH SPEED SINGLE OPERATIONAL AMPLIFIER

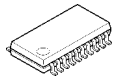
■ GENERAL DESCRIPTION

The **NJM2710** is an ultra high speed hex operational amplifier.

It can swings 260V/μs high slew rate and 1GHz gain band width product(10MHz typ. at 40dB) at 5V.

It is suitable for telecommunication related system, digital broadcasting system, high quality scanner and any other high speed signal processing system.

■ PACKAGR OUTLINE



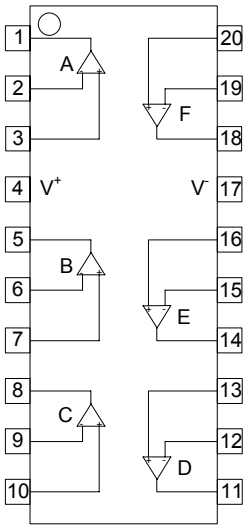
NJM2710M

NJM2710V

■ FEATURES

- Operating Voltage (±2.0 to ±4.5V)
- Operating Current (11.4mA typ. at V^+/V^-=±2.5V)
- High Slew Rate (260V/μs typ.)
- Gain Bandwidth Product (1GHz typ.)
  Bandwidth (10MHz typ. at 40dB)
- Unity Gain Bandwidth (180MHz typ.)
- Input Offset Voltage (7mV max.)
- Maximum Output Voltage (±1.5V typ. at R_L=1kΩ)
- Open Loop Voltage Gain (75dB typ.)
- Bipolar Technology
- Package Outline DMP20,SSOP20

■ PIN CONFIGURATION



NJM2710E
NJM2710V
(TOP VIEW)

Pin Function

1. A OUTPUT	**11. D OUTPUT**
2. A -INPUT	**12. D -INPUT**
3. A +INPUT	**13. D +INPUT**
4. V^+	**14. E OUTPUT**
5. B OUTPUT	**15. E -INPUT**
6. B -INPUT	**16. E +INPUT**
7. B +INPUT	**17. V^-**
8. C OUTPUT	**18. F OUTPUT**
9. C -INPUT	**19. F -INPUT**
10. C +INPUT	**20. F +INPUT**

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	10	V
Differential Input Voltage	V_{ID}	±2	V
Power Dissipation	P_D	(DMP20,SSOP20)375	mW
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-50 to +150	°C

■ DC CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Operating Voltage Range	V^+/V^-		2.0	2.5	4.5	V
Operating Current	I_{CC}	No Signal	-	11.4	20.4	mA
Input Offset Voltage	V_{IO}		-	2.0	7.0	mV
Input Bias Current	I_B		-	2	7	μA
Input Offset Current	I_{IO}		-	350	900	nA
Open Loop Voltage Gain	Av	R_L=2kΩ	65	75	-	dB
Input Common Mode Voltage Range	V_{ICM}		±1.3	±1.5	-	V
Common Mode Rejection	CMR	-1V≤V_{CM}≤+1V	50	60	-	dB
Supply Voltage Rejection	+SVR	2.5V≤V^+≤5V, R_L=2kΩ	50	60	-	dB
	-SVR	-5V≤V^-≤-2.5V, R_L=2kΩ	50	60	-	dB
Maximum Output Voltage	V_{OM}	R_L=1kΩ	±1.2	±1.5	-	V

■ AC CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Bandwidth	BW	Av=40dB,R_f=1.98kΩ ,R_L=∞ C_L=10pF	-	10	-	MHz
Unity Gain Bandwidth	f_T	Av=40dB,Rg=20Ω,R_f=1.98kΩ R_L=∞,C_L=10pF	-	180	-	MHz
Phase Margin	ϕ_M	Av=40dB,Rg=20Ω,R_f=1.98kΩ R_L=∞,C_L=10pF	-	38	-	deg
Equivalent Input Noise Voltage	V_{NO}		-	6.8	-	nV/√Hz

■ TRANSIENT CHARACTERISTICS (V^+/V^-=±2.5V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Slew Rate	+SR	Av=6dB,R_f=1kΩ,Rg=1kΩ R_L=∞,CL=10pF	-	260	-	V/μs
	-SR		-	260	-	V/μs

■ Note:

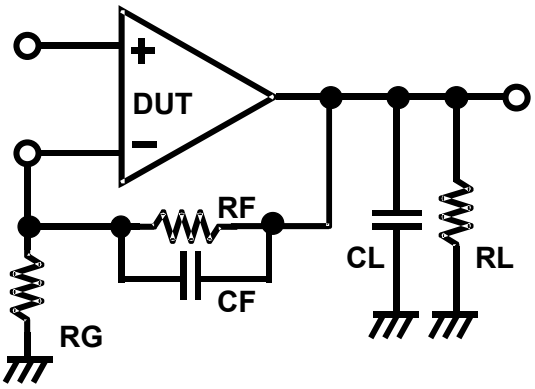
non-inverting amplifier

1.The closed gain should be 6dB or higher to prevent the oscillation.
Unity gain follower application may cause the oscillation.
2.When the closed gain is lower than 20dB, use a compensation capacitor (CF: about 5pF), parallel with the feedback resistor RF to avoid oscillation.
3.Recommended feedback resistor is less than 2kΩ to keep the flatness of the frequency response.
4.Minimize the load capacitor for the better performance.
A large load capacitor CL reduces the frequency response and causes oscillation or ringing.

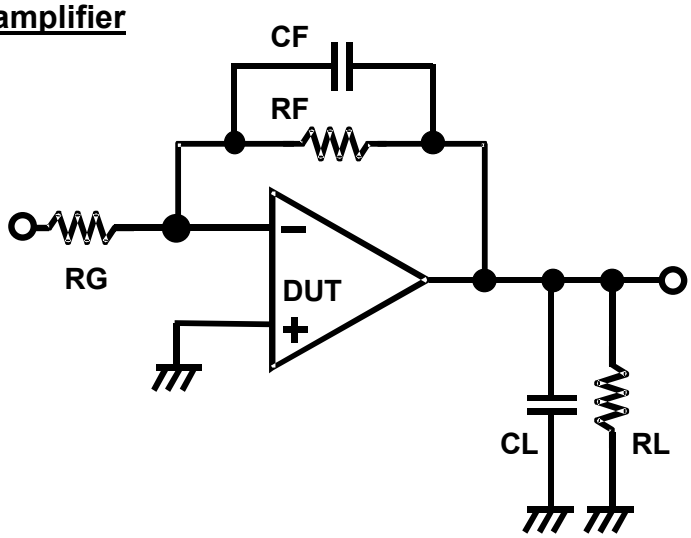
inverting amplifier

1.When the closed gain is lower than 20dB, use a compensation capacitor (CF; recommended from 1pF to 5pF), parallel with the feedback resistor RF to avoid oscillation.
2.Minimize the feedback resistor to keep the frequency response and the slew rate. (recommended about 1k-ohom)
The proper compensation capacitor CF can counteract oscillation even with a large feedback resistor RF.
3.Total load capacitance should be not more than 100pF.
The oscillation margin may be affected by the total load capacitance.

non-inverting amplifier



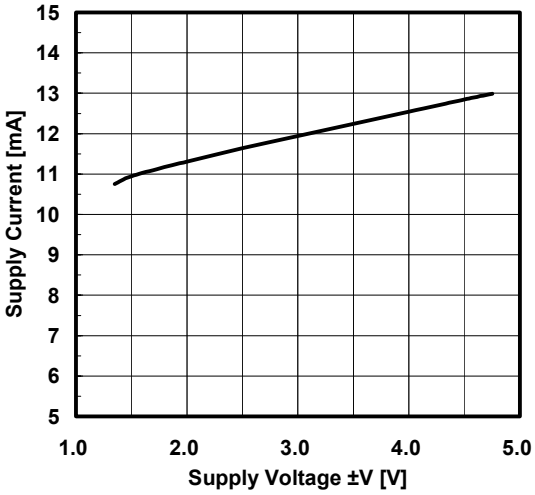
inverting amplifier



■ TYPICAL CHARACTRERISTICS

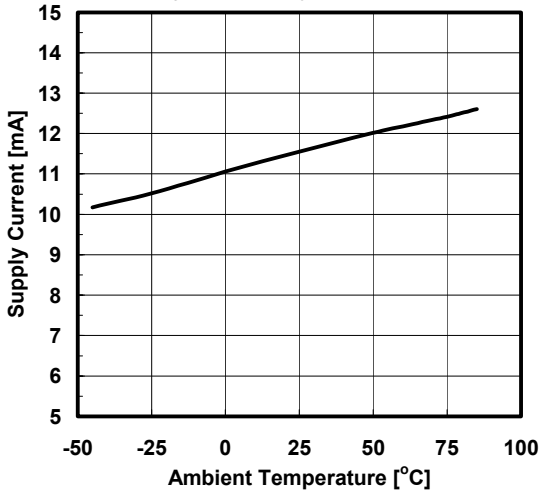
Supply Current vs. Supply Voltage

V_{IN}=No Signal,G_V=6dB,R_S=50Ω
R_F=1kΩ,R_G=1kΩ,R_L=2kΩ,Ta=+25°C



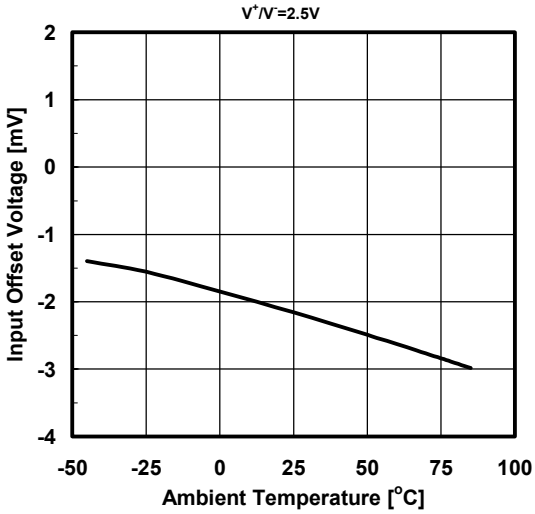
Supply Current vs. Ambient Temperature

V^+/V^-=±2.5V,V_{IN}=No Signal,G_V=6dB
R_S=50Ω,R_F=1kΩ,R_G=1kΩ,R_L=2kΩ



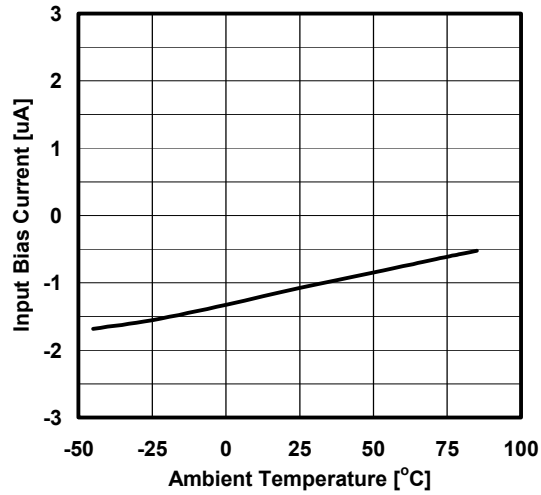
Input Offset Voltage vs. Ambient Temperature

V^+/V^-=2.5V



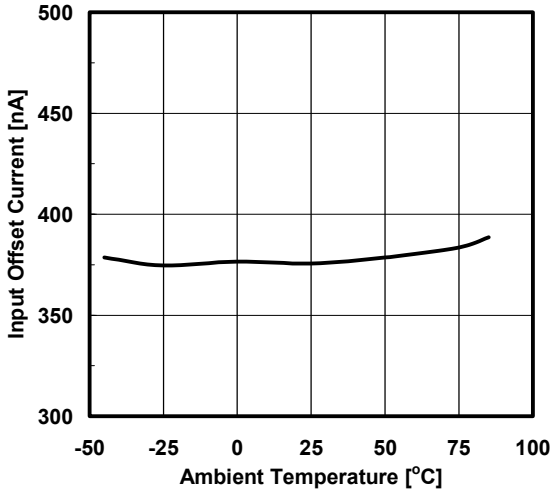
Input Bias Current vs. Ambient Temperature

V^+/V^-=2.5V



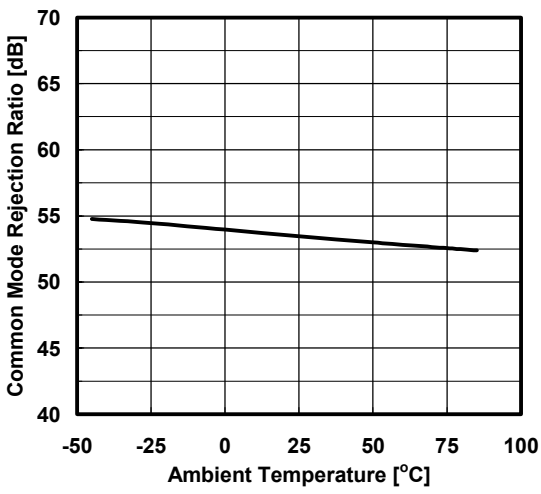
Input Offset Current vs. Ambient Temperature

V^+/V^-=2.5V



Common Mode Rejection Ratio vs. Ambient Temperature

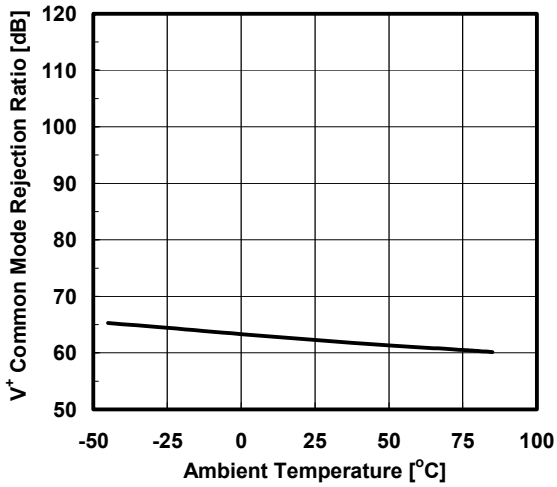
V^+/V^-=2.5V



■ TYPICAL CHARACTRERISTICS

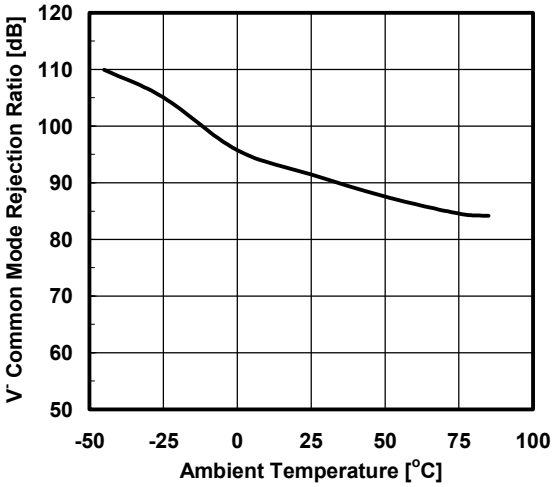
V^+ Common Mode Rejection Ratio vs. Ambient Temperature

V^+/V^-=2.5V



V^- Common Mode Rejection Ratio vs. Ambient Temperature

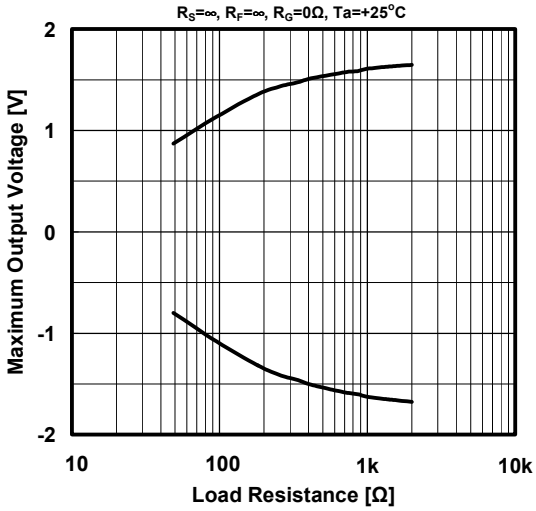
V^+/V^-=2.5V



Maximum Output Voltage vs. Load Resistance

V^+/V^-=±2.5V, V_{IN}=+1V or -1V, G_V=open

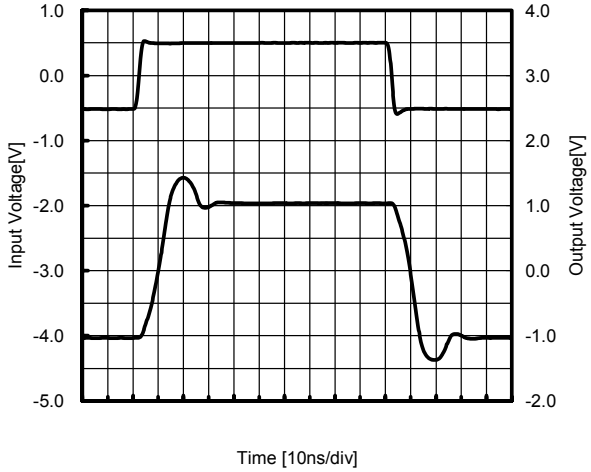
R_S=∞, R_F=∞, R_G=0Ω, Ta=+25°C



■ TYPICAL CHARACTRERISTICS

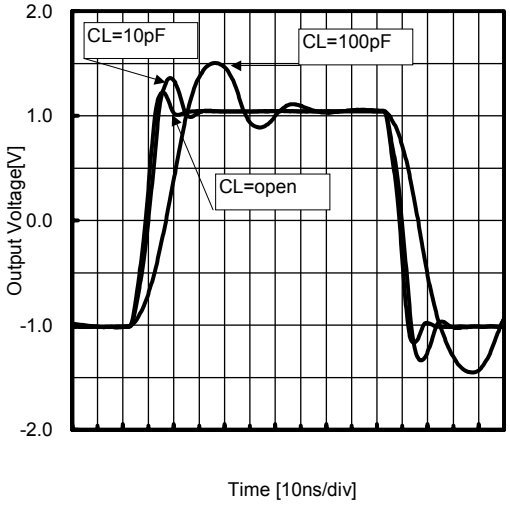
Pulse Responce

V^+/V^-=±2.5V,f=5MHz,V_O=2VPP,G_V=6dB,R_T=50Ω,
R_F=1kΩ,C_F=5pF,R_G=1kΩ,R_L=2kΩ,C_L=10pF,Ta=+25℃



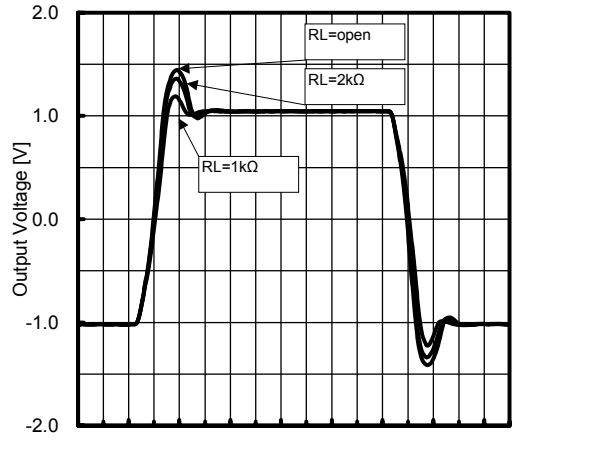
Pulse Response (with capacitive load)

V^+/V^-=±2.5V,f=5MHz,V_O=2VPP,G_V=6dB,
R_T=50Ω,R_F=1kΩ,C_F=5pF,R_G=1kΩ,Ta=+25℃



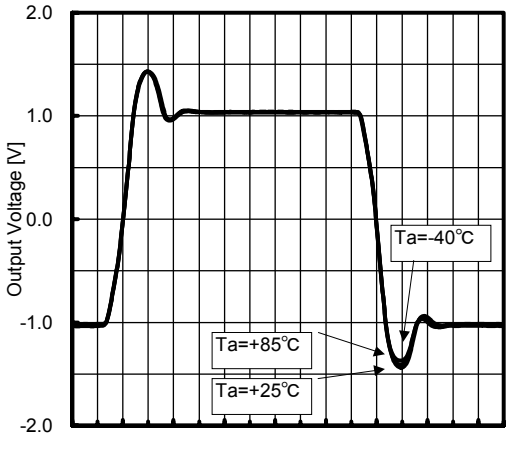
Pulse Response (correlation with RL)

V^+/V^-=±2.5V,f=5MHz,V_O=2V_{PP},G_V=6dB,R_T=50Ω,
R_F=1kΩ,C_F=5pF,R_G=1kΩ,C_L=10pF,Ta=+25℃



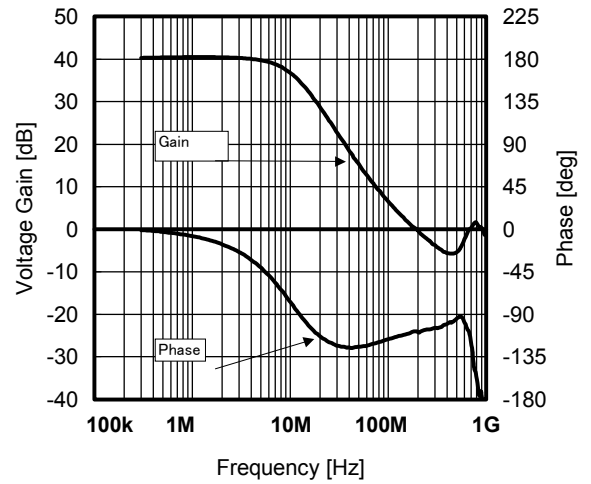
Pulse Response (correlation with Ta)

V^+/V^-=±2.5V,f=5MHz,V_O=2VPP,G_V=6dB,R_T=50Ω,
R_F=1kΩ,C_F=5pF,R_G=1kΩ,C_L=10pF,Ta=+25℃



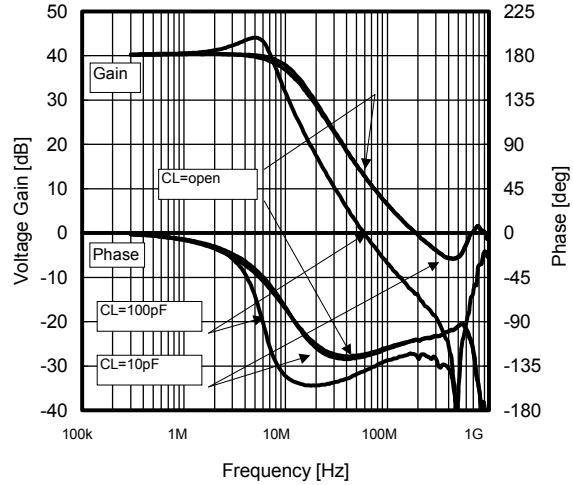
Voltage Gain vs. Frequency

V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=40dB,R_T=50Ω,
R_F=1.98kΩ,R_G=20Ω,C_F=5pF,R_L=2kΩ,C_L=10pF,Ta=+25℃



Voltege Gain vs. Frequency (with Capacitive Load)

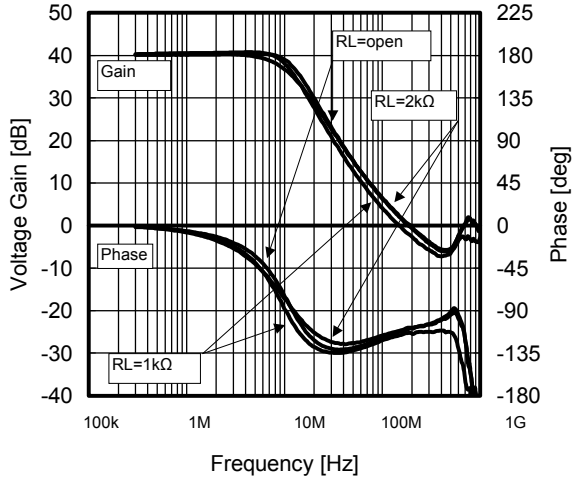
V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=40dB,R_T=50Ω,
R_F=1.98kΩ,R_G=20Ω,C_F=5pF,R_L=2kΩ,Ta=+25℃



■ TYPICAL CHARACTRERISTICS

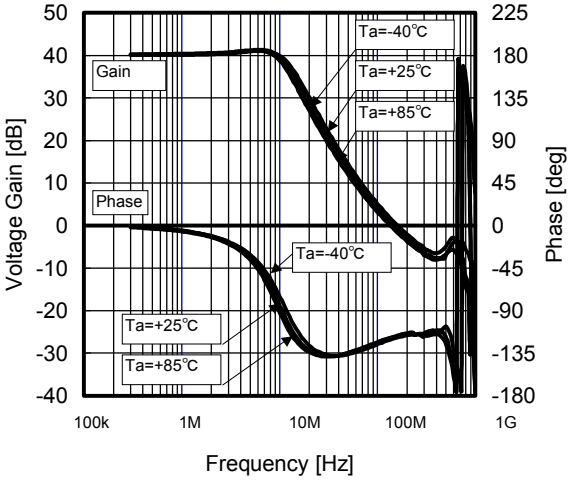
Voltage Gain vs. Frequency
(correlation with RL)

V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=40dB,R_T=50Ω,
R_F=1.98kΩ,R_G=20Ω,C_F=5pF,C_L=10pF,Ta=+25℃



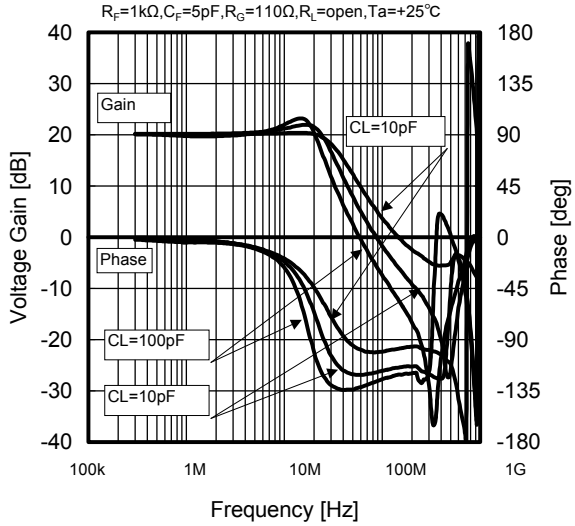
Voltage Gain vs. Frequency
(correlation with Ta)

V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=40dB,R_T=50Ω, R_F=1.98kΩ,
R_G=20Ω,C_F=5pF,R_L=open,C_L=10pF



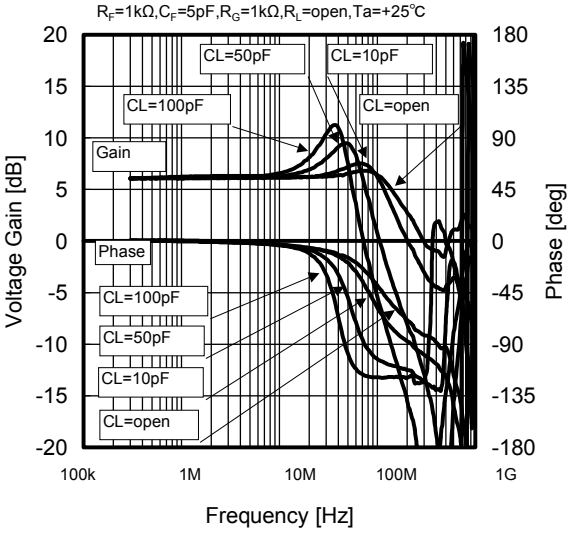
Voltage Gain vs. Frequency(with Capacitive Load)

V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=20dB,R_T=50Ω,
R_F=1kΩ,C_F=5pF,R_G=110Ω,R_L=open,Ta=+25℃



Voltage Gain vs. Frequency (with Capacitive Load)

V^+/V^-=±2.5V,V_{IN}=0.02Vpp,G_V=6dB,R_T=50Ω,
R_F=1kΩ,C_F=5pF,R_G=1kΩ,R_L=open,Ta=+25℃



■ MEASUREMENT CIRCUIT